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The Mineral Industry of the Federal Republic of Germany

UNITED STATES DEPARTMENT OF THE INTERIOR

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The Mineral Industry of the Federal Republic of Germany

By George A. Rabchevsky[1]

The Federal Republic of Germany's (FRG) automobile industry suffered a sharp drop in new car sales early in 1987, and the steel industry faced further production cuts and plant closings because of poor export demand and strong competition. Because of impending production decreases, thousands of steel workers were planned to be laid off in North Rhine-Westphalia, causing workers' strikes. The coal industry was also hard hit by the appreciation of the deutsche mark, forcing the Government to increase subsidies and raise special coal taxes paid by the electricity consumers.

The FRG's real economic growth in the 1980's weakened considerably compared with the growth in the previous three decades. The gross national product (GNP) at $1,125.1 billion[2] was third largest among the market economy countries, exceeded only by the United States and Japan. In 1987, the GNP reportedly grew by only 1.7% in real terms, compared with 2.5% in 1986, and 2% in 1985. The weak U.S. dollar and bargain prices for oil and imported raw materials partly contributed to the slow growth of the economy.

The country's general economic conditions declined, especially in the north, where restructuring and/or closure of steel mills and mines resulted in decreased output and persistent unemployment, necessitating increasing subsidies to steel, coalmining, and shipbuilding industries. The south, on the other hand, continued to prosper, offering employment to displaced workers in the north. Although the unemployment situation decreased slightly in the FRG in comparison with previous years, the total number of unemployed remained virtually unchanged at 2.23 million workers. Moreover, the country's private sector had the highest employment costs in the world and the highest rate of taxation on corporate profits. Also, the unwillingness of workers to relocate or retrain contributed to the FRG's high public relief and taxation programs. Throughout the country, union workers from the North Rhine-Westphalia and the Ruhr Valley areas staged demonstrations and strikes to protest working conditions. The number of strikers affected included 2.5 million members of IG Metall, the metal workers' union, out of a total of about 3.9 million metal workers in the country. Workers' demands included a reduction of the 38-hour workweek to 36.5 hours. A metal worker in the FRG spent 1,669 working hours per year on the job, compared to Japan with 2,104 hours and the United States with 1,920 hours. The metals industry generated about 20% of the country's GNP.

North Rhine-Westphalia was the most industrialized state in the country. The chemical industry was the largest industrial sector, followed by machine tool and food processing industries. The iron and steel industry ranked fourth with a 1986 turnover of $18.4 billion, followed by automobile manufacturing and electroengineering. Coal mining was in seventh place with a turnover of $14.9 billion. About 33% of the 500 largest companies in the FRG were in North Rhine-Westphalia. Ten firms in the State ranked among the FRG's top 20 companies. The Ruhr Valley area to its south, on the other hand, was an economically depressed region, with low employment as a result of the coal and steel industry crises. Coal subsidies continued; only about 20% of FRG's coal mines were competitive.

A new law on venture-capital corporations, unternehmungs-beteiligungs-gesell-

schaften (UBGG), went into effect at the beginning of 1987. UBGG was designed to provide an entry to the stock market for medium-size enterprises. The first companies to take advantage of the new law were, reportedly, from the State of Bavaria in the south, where the last operating iron ore mine was shut down during the year.

PRODUCTION

The FRG has had a long history of mining and metals production, and it was relatively well endowed with certain mineral resources. However, changing world trade patterns and technologies altered traditional smokestack industries, resulting in declining production and mine closures. Instead, mining, minerals, and metals production industries have been largely replaced by the FRG's technology-intensive industries. Most major heavy industries, such as the steel and chemical industries, began in the late 1850's and eventually transformed themselves into high-technology manufacturers and materials processors. Total research and development expenditures in 1987 amounted to about $35 billion, or more than double the 1977 level. Research and development accounted for 2.5% of GNP, placing the FRG in second place behind Japan and ahead of the United States.[3] According to some analysts, many traditional metal markets were under attack from industrial minerals such as plastics, ceramics, and silica and carbon fibers, and the FRG metals industry sought new means to apply high technology in metals processing to stay competitive.[4] For example, Vereinigte Deutsche Metallwerke AG (VDM), the wholly owned subsidiary of Metallgesellschaft AG (MG), and Special Metals Corp. (SMC), a subsidiary of Astro-Tech International Inc. of the United States, agreed to cooperate in the European and U.S. markets. VDM and SMC planned to undertake joint research and development into various fields, such as special alloys or electronics applications.[5]

The FRG planned to drill the deepest hole in the world near Erbendorf in the Upper Palatinate, the State of Bavaria, as part of the International Lithosphere Program, at a cost of $273 million. The 14-kilometer deep hole would provide more data on the structure of the earth's crust, the possibilities of harnessing geothermal heat, and exploration for mineral deposits such as oil, gas, and ores. The deepest borehole to date is in the Kola Peninsula; it was drilled by the Soviet Union to a depth of 12.5 kilometers.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Aluminum:					
Bauxite, gross weight	359	343	275	410	400
Alumina thousand tons	1,580	1,701	1,657	1,560	1,320
Metal:					
Primary do.	743	777	745	765	730
Secondary:					
Alloyed do.	387	402	415	441	460
Unalloyed do.	41	44	44	40	35
Cadmium metal, smelter	1,094	1,111	1,095	1,185	1,200
Copper:					
Mine output, Cu content	1,209	1,046	857	834	[2]1,483
Metal:					
Smelter:					
Primary	159,100	148,800	[r]152,400	161,900	161,000
Secondary	94,500	76,700	94,600	76,700	76,500
Total	253,600	225,500	247,000	238,600	237,500

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS —Continued					
Copper —Continued					
Metal —Continued					
Refined including secondary:					
Electrolytic	332,846	297,854	[r]330,034	339,052	[2]399,918
Fire-refined	87,928	[r]81,144	[r]84,131	82,948	--
Total	420,774	[e]378,998	[r]414,165	[r e]422,000	[2]399,918
Gold:[e]					
Mine output, Au content troy ounces	1,900	1,500	1,200	1,200	850
Metal including secondary do.	350,000	350,000	350,000	350,000	350,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	976	977	1,034	717	[2]247
Fe content do.	279	293	309	212	[2]68
Metal:					
Pig iron do.	26,598	30,203	31,531	29,018	[2]28,517
Blast furnace ferromanganese, spiegeleisen, ferrosilicon do.	174	309	205	256	260
Ferroalloys, electric furnace do.	119	156	[r]171	206	185
Steel, crude do.	35,729	39,389	40,497	37,134	[2]36,248
Semimanufactures do.	26,061	27,957	28,919	27,540	[2]27,437
Lead:					
Mine output, Pb content	23,523	20,998	20,496	16,736	[2]18,844
Metal:					
Smelter:					
Primary	116,216	102,289	109,674	111,092	[2]113,601
Secondary	236,259	254,944	246,586	255,529	229,380
Total	352,475	357,233	356,260	366,621	[2]342,981
Refined:					
Primary	217,000	191,900	181,000	182,000	160,700
Secondary	135,500	165,300	175,300	184,500	[2]182,300
Total	352,500	357,200	356,300	366,600	[2]343,000
Mercury (secondary only) 76-pound flasks	2,005	--	--	--	--
Nickel metal including secondary[e 3]	1,200	1,000	700	--	--
Platinum[e] troy ounces	2,450	2,000	2,200	1,800	2,000
Silver:					
Mine output, Ag content thousand troy ounces	1,167	1,225	1,090	884	[2]1,736
Metal including secondary[e] do.	18,600	21,500	20,500	20,000	22,000
Tin metal including secondary[e]	[2]417	417	400	350	300
Zinc:					
Mine output:					
Zn content	113,500	113,100	117,600	103,706	[2]102,153
Zn content, recoverable	92,562	92,467	95,505	84,786	[2]80,542
Metal, unwrought, unalloyed:					
Primary	328,689	325,567	339,876	344,309	348,280
Secondary	27,848	30,825	27,887	26,622	[2]29,281
Total	356,537	356,392	367,763	370,931	[2]377,561
INDUSTRIAL MINERALS					
Abrasives: Artificial corundum	74,201	88,962	91,506	[e]92,000	90,000
Barite	163,965	166,568	171,269	201,565	185,000
Bromine	3,136	3,306	3,977	[e]2,500	2,500
Cement and clinker:					
Cement (excluding clinker) thousand tons	30,466	28,909	25,758	26,580	25,300
Clinker do.	702	742	599	599	870
Clays:					
Fire clay excluding klebsand do.	5,792	[e]5,800	5,384	5,534	5,500
Kaolin, marketable do.	407	360	410	512	500
Bleaching do.	601	628	1,595	1,319	1,300
Other (schieferton) do.	75	69	75	80	75
Diatomite and similar earth, marketable	44,195	49,009	48,427	49,432	49,000
Feldspar, marketable	330,000	297,850	322,000	[e]305,000	300,000
Fluorspar, marketable:					
Acid-grade[e]	69,646	72,098	74,824	79,951	79,650
Metallurgical-grade[e]	11,064	11,170	8,314	8,883	8,850
Total	80,707	83,268	83,138	88,834	88,500

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
INDUSTRIAL MINERALS —Continued					
Graphite:					
Crude	19,754	18,756	20,958	23,226	22,000
Marketable[5]	12,012	12,356	12,798	13,233	12,000
Gypsum and anhydrite, marketable thousand tons	1,721	2,485	2,262	2,367	1,900
Lime (hydrated), quicklime, dead-burned dolomite do	6,871	6,941	6,845	6,476	[2]6,111
Nitrogen: N content of ammonia do	1,703	1,963	1,908	1,570	[2]1,931
Phosphates: Thomas slag-based fertilizer, P_2O_5 content do	93	62	67	54	50
Pigments, mineral, natural	19,886	16,178	15,764	11,365	12,000
Potash, K_2O equivalent:					
Crude, marketable thousand tons	87	92	88	85	[2]84
Chemically processed do	2,332	2,553	2,495	2,076	[2]2,115
Total do	2,419	2,645	2,53	2,161	[2]2,199
Pumice:					
Crude and washed do	645	1,013	690	612	[2]580
Marketable do	200	355	207	215	205
Pyrites, marketable concentrate, gross weight do	554	514	512	471	200
Quartz, quartzite, glass sand:					
Quartzite do	331	362	346	339	[2]290
Quartz sand, ground do	337	316	304	317	[2]316
Quartz sand, unground and glass sand do	7,391	7,195	7,021	6,557	[2]6,128
Salt, marketable:					
Rock do	6,265	7,110	9,654	9,115	9,200
Marine and other do	4,603	5,102	3,426	3,987	4,000
Sodium compounds:					
Carbonate do	1,218	1,364	1,412	1,442	[2]1,448
Sulfate, synthetic do	125	128	139	163	165
Stone, sand and gravel:					
Dimension stone[3] thousand cubic meters	237	291	254	257	[2]264
Limestone, industrial thousand tons	44,371	43,505	40,403	40,267	[2]41,059
Crushed and broken stone do	91,445	97,439	94,072	101,189	[2]99,755
Slate do	62	23	28	[e]25	[2]22
Basalt lava and lava sand do	6,350	7,482	7,544	7,657	7,600
Calcite do	4	3	2	--	--
Grinding stone[4] cubic meters	40	42	40	40	45
Sand and gravel thousand tons	146,414	143,278	131,014	142,555	[2]137,050
Sulfur, byproduct:					
Of metallurgy[6] do	400	350	320	300	300
Of natural gas do	632	851	964	998	1,030
Of petroleum[6] do	195	190	200	190	210
Unspecified[6] do	95	90	85	85	85
Total do	1,322	1,481	1,569	1,573	1,625
Talc including talc schist do	14	17	21	22	21
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	362,125	382,420	387,134	383,666	[2]361,982
Coal:					
Anthracite and bituminous thousand tons	82,202	79,426	82,396	80,801	[2]76,300
Lignite do	124,281	126,739	120,667	114,310	[2]108,799
Total do	206,483	206,165	203,063	195,111	185,099
Coke, metallurgical do	22,427	20,586	22,331	22,254	[2]19,674
Fuel briquets:					
Of anthracite and bituminous coal do	1,244	1,437	1,511	1,199	[2]1,001
Of lignite do	3,568	3,818	4,068	3,630	[2]3,188
Gas:					
Manufactured (excluding that from petroleum refineries):[6]					
Blast furnace million cubic feet	145,917	174,345	176,641	159,795	[2]154,145
Coke oven do	185,858	174,345	187,588	190,025	[2]166,788
Natural, gross do	622,339	563,258	510,605	489,629	[2]560,468
Peat:					
Agricultural use thousand tons	1,868	1,429	1,516	2,017	[2]2,002
Fuel use do	259	277	284	246	[2]240

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum:					
Crude thousand 42-gallon barrels	29,739	29,289	29,650	29,015	[2]27,447
Refinery products:					
Gasoline, motor do.	170,885	170,629	[r]173,293	166,054	[2]160,072
Jet fuel (including aviation gasoline): do.	11,231	13,318	13,797	14,140	[2]14,774
Kerosene do.	356	295	[r]364	543	[2]550
Distillate fuel oil do.	252,029	260,018	256,691	259,668	[2]242,517
Residual fuel oil do.	104,649	92,701	[r]69,117	65,468	[2]58,355
Lubricants do.	8,687	11,205	10,656	9,988	[2]9,961
Liquefied petroleum gas do.	23,942	24,511	25,462	23,276	[2]24,963
Bitumen do.	19,460	18,514	17,076	16,915	[2]16,259
Unspecified do.	45,809	42,662	[r]52,299	46,576	4,904
Refinery fuel and losses do.	50,169	48,769	46,557	46,403	[2]45,682
Total do.	687,217	682,625	665,312	649,025	622,037

[e]Estimated [p]Preliminary [r]Revised

[1]Table includes data available through June 1988.

[2]Reported figure.

[3]Primary nickel and nickel contained in ferronickel, Monel metal, and nickel oxide directly used by the steel industry.

[4]Includes imported stock.

[5]Incomplete data.

[6]Other types of manufactured gas may be produced but production data are not reported, and available information is inadequate to make reliable estimates. Estimates presented in previous editions of this yearbook are considered unreliable.

TRADE

FRG's foreign-trade balance declined slightly, with imports rising while exports decreased because of low external demand. Nevertheless, FRG exported approximately one-third of its GNP, a share much higher than that of Japan or the United States. Exports in 1986, in terms of value, were the largest in the world, and most likely remained so in 1987. FRG's share of world trade in 1986 was about 11.3%, followed by the United States with 10.1%, and Japan, in third place, at 9.8%. However, only about 8.5% of FRG exports consisted of nonmanufactured goods, such as food products, semimanufactures, and raw materials. Over one-half of FRG's 1986 exports were to its 11 trading partners in the European Economic Community (EEC), France being its largest importer. Exports to the United States amounted to 10.5% of the total.

Direct foreign investment by the FRG had gradually increased from 1977 to 1987. In 1986, 30% of all direct foreign investments were made in the United States, representing an eightfold increase since 1976. The Government explained the trend by saying that only through increasing internationalization of its business can export-intensive firms hope to maintain and strengthen their market position. MG, a multifaceted mining and metals processing company, with international interests and one of the country's largest corporations, concentrated all of its international mining operations in a Toronto-based subsidiary, Metall Mining Corp. Ltd. (MMC). MMC filed a prospectus for a share issue to be made both in Canada and internationally. The new company was to acquire MG's international mining interests in Teck Cominco in Canada and in MIM Holdings Ltd. in Australia, as well as joint-venture participations in Australia, Canada, Papua New Guinea, and Turkey. MMC was expected to expand these interests. MG's action was part of a reorganization of all of its major mining activities. Its existing wholly owned subsidiary in Canada, Metallgesellschaft Canada Investments Ltd. (MCI), was incorporated into the new MMC.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkaline-earth metals	82	161	1	France 80; Belgium-Luxembourg 58; Netherlands 10.
Aluminum:				
Ore and concentrate	42,212	25,144	--	Belgium-Luxembourg 6,934; France 6,492; Austria 4,377.
Oxides and hydroxides	668,347	496,518	17,805	Austria 108,637; Canada 70,573; Italy 59,827.
Ash and residue containing aluminum	13,061	21,313	--	Finland 4,803; Netherlands 4,611; France 4,590.
Metal including alloys:				
Scrap	89,691	104,453	--	Italy 41,253; Netherlands 24,844; Belgium-Luxembourg 14,985.
Unwrought	281,694	300,882	890	France 74,714; Italy 51,197; Austria 47,998.
Semimanufactures	551,622	545,672	28,865	France 83,479; United Kingdom 78,989; Italy 54,927.
Antimony:				
Oxides	592	747	90	Switzerland 134; Belgium-Luxembourg 88.
Metal including alloys, all forms	104	53	(3)	Spain 19; Austria 12; United Kingdom 6.
Arsenic: Oxides and acids	367	219	(3)	United Kingdom 81; Italy 70; Yugoslavia 43.
Beryllium:				
Oxides and hydroxides	(3)	(3)	NA	NA.
Metal including alloys, all forms	(3)	(3)	(3)	Mainly to France.
Bismuth: Metal including alloys, all forms	251	77	2	United Kingdom 33; Italy 10.
Cadmium:				
Oxides and hydroxides	38	15	NA	NA.
Metal including alloys, all forms	296	438	NA	NA.
Cesium and rubidium: Metal including alloys, all forms	(3)	(3)	--	Mainly to Singapore.
Chromium:				
Ore and concentrate	8,909	12,061	--	France 3,904; Austria 1,983; Denmark 1,469.
Metal including alloys, all forms	126	133	20	United Kingdom 40; Belgium-Luxembourg 13.
Cobalt:				
Oxides and hydroxides	87	57	NA	Italy 21; Spain 13; Netherlands 10.
Metal including alloys, all forms	913	1,589	3	Italy 105; France 82; unspecified 1,236.
Columbium and tantalum:				
Ore and concentrate	1,895	54	NA	NA.
Ash and residue containing columbium or tantalum	2	327	268	Netherlands 56; Austria 3.
Metal including alloys, all forms:				
Columbium (niobium)	82	83	(3)	Japan 2; France 1; unspecified 76.
Tantalum	118	92	(3)	India 2; Japan 2; unspecified 87.
Copper:				
Ore and concentrate	47	--		
Matte and speiss including cement copper	627	828	--	Canada 481; Netherlands 326; Spain 21.
Oxides and hydroxides	2,379	2,317	55	United Kingdom 397; Denmark 308; Spain 224.
Sulfate	1,533	1,945	NA	NA.
Ash and residue containing copper	17,713	15,909	5	Austria 5,722; India 4,598; Belgium-Luxembourg 2,832.
Metal including alloys:				
Scrap	77,294	70,084	108	Netherlands 20,200; Italy 20,091; Belgium-Luxembourg 9,505.
Unwrought	105,562	68,561	231	France 14,526; United Kingdom 10,962; Sweden 9,416.
Semimanufactures	475,007	470,822	45,329	France 60,398; Italy 54,731.
Gallium: Metal including alloys, all forms	9	9	2	Japan 3; Switzerland 2.
Germanium: Metal including alloys, all forms	1	1	(3)	Mainly to Japan.
Gold:				
Ash and residue containing gold value, thousands	$1,592	$1,494	--	United Kingdom $954; Netherlands $539.
Waste and sweepings ------do	$9,390	$1,087	$86	United Kingdom $382; Switzerland $268; Belgium-Luxembourg $238.
Metal including alloys, unwrought and partly wrought thousand troy ounces	1,496	2,109	555	Switzerland 640; United Kingdom 221.
Hafnium: Metal including alloys, all forms	(3)	(3)	--	All to Japan.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	2,576	4,591	--	France 1,824; Austria 1,210; Netherlands 896.
Pyrite, roasted	16,930	16,581	--	Belgium-Luxembourg 14,506; France 1,956; Austria 98.
Metal:				
Scrap thousand tons	3,632	3,418	(3)	Italy 1,704; Belgium-Luxembourg 610; Netherlands 388.
Pig iron, cast iron, related materials	722,367	527,598	574	France 320,803; Italy 67,552; Netherlands 46,392.
Ferroalloys:				
Ferrochromium	58,445	39,627	6,141	France 14,272; India 2,709.
Ferromanganese	65,808	68,851	22,781	France 10,367; Belgium-Luxembourg 8,386.
Ferromolybdenum	503	345	--	Belgium-Luxembourg 106; Sweden 58; Netherlands 50.
Ferronickel	2,023	797	--	Sweden 522; France 132; Netherlands 90.
Ferrosilicochromium	3,021	5,056	--	Belgium-Luxembourg 2,007; Italy 1,898; France 500.
Ferrosilicomanganese	3,682	4,002	--	Belgium-Luxembourg 905; Switzerland 800; Netherlands 718.
Ferrosilicon	69,445	65,549	695	Italy 13,280; France 11,149; Belgium-Luxembourg 8,468.
Silicon metal	9,606	7,820	438	Italy 1,803; Austria 1,706; France 1,326.
Unspecified	14,046	13,721	71	Italy 692; Sweden 480; unspecified 10,773.
Steel, primary forms thousand tons	5,207	4,182	52	France 471; Italy 454.
Semimanufactures:				
Bars, rods, angles, shapes, sections do.	3,336	2,905	188	France 620; Netherlands 478; Belgium-Luxembourg 214.
Universals, plates, sheets do.	5,997	5,443	736	U.S.S.R. 809; France 481.
Hoop and strip do.	1,382	1,305	43	France 187; Netherlands 154; Switzerland 138.
Rails and accessories do.	259	172	25	Italy 46; Netherlands 23.
Wire do.	322	301	23	France 63; Netherlands 50; Belgium-Luxembourg 39.
Tubes, pipes, fittings do.	4,371	3,816	153	U.S.S.R. 1,326; China 363; Netherlands 357.
Castings and forgings, rough do.	159	147	7	France 20; Belgium-Luxembourg 19; Austria 17.
Lead:				
Ore and concentrate	9,991	9,822	--	France 9,794; Netherlands 25; United Kingdom 2.
Oxides	9,656	19,050	NA	Netherlands 4,790; Sweden 2,835; Belgium-Luxembourg 2,811.
Ash and residue containing lead	18,937	11,193	NA	Belgium-Luxembourg 4,931; United Kingdom 3,935; France 1,460.
Metal including alloys:				
Scrap	14,558	11,496	--	Netherlands 10,516; Austria 389; Italy 276.
Unwrought	106,992	95,676	98	Italy 30,397; Austria 16,027; Denmark 8,757.
Semimanufactures	16,888	17,104	130	Denmark 4,527; Switzerland 1,433; unspecified 3,629.
Lithium:				
Oxides and hydroxides	761	694	--	Italy 175; United Kingdom 135; Netherlands 133.
Metal including alloys, all forms	71	54	(3)	Switzerland 36; Japan 7; France 4.
Magnesium: Metal including alloys:				
Scrap	1,665	1,370	429	Netherlands 368; Italy 264.
Unwrought	504	227	--	France 95; Belgium-Luxembourg 60; Austria 28.
Semimanufactures	1,296	1,071	2	Belgium-Luxembourg 341; France 90; Netherlands 87.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate, metallurgical grade	1,144	1,000	22	Yugoslavia 466; France 253; Netherlands 70.
Oxides	972	808	NA	Belgium-Luxembourg 448; Italy 88; Yugoslavia 69.
Metal including alloys, all forms	118	193	5	Belgium-Luxembourg 59; United Kingdom 43; Yugoslavia 21.
Mercury 76-pound flasks	4,350	3,239	NA	Italy 592; France 403; Venezuela 174.
Molybdenum:				
Ore and concentrate	3,526	4,045	29	Netherlands 1,721; Austria 1,712; Belgium-Luxembourg 443.
Oxides and hydroxides	NA	1,191	94	Austria 794; Sweden 91.
Metal including alloys:				
Unwrought and scrap	603	598	NA	NA.
Semimanufactures	46	38	(3)	Brazil 12; Austria 7; Spain 3.
Nickel:				
Ore and concentrate	1			
Matte and speiss	1,491	1,727	—	Belgium-Luxembourg 1,273; Spain 192; Netherlands 159.
Oxides and hydroxides	58	99	—	Yugoslavia 48; Belgium-Luxembourg 18; Austria 12.
Ash and residue containing nickel	4,993	2,622	—	Austria 1,070; Belgium-Luxembourg 623; Netherlands 604.
Metal including alloys:				
Scrap	10,032	5,668	372	Sweden 4,245; Netherlands 573.
Unwrought	6,620	6,193	(3)	France 3,746; Netherlands 973; Belgium-Luxembourg 377.
Semimanufactures	14,099	12,294	3,535	France 1,972; Italy 936.
Platinum-group metals:				
Ash and residue containing platinum value, thousands	$623	$68	NA	Belgium-Luxembourg $56.
Waste and sweepings do	$1,368	$2,501		United Kingdom $1,518; Spain $510; Netherlands $280.
Metals including alloys, unwrought and partly wrought:				
Palladium troy ounces	187,215	166,843	22,570	United Kingdom 40,703; Switzerland 25,078.
Platinum do	278,148	260,423	25,751	Switzerland 100,215; United Kingdom 21,033.
Unspecified do	161,672	127,860	16,272	Japan 26,760; Netherlands 20,009.
Rare-earth metals including alloys, all forms	34	18	4	Japan 3; Italy 2.
Rhenium: Metal including alloys, all forms	(3)	(3)	—	Mainly to Yugoslavia.
Silver:				
Ash and residue containing silver value, thousands	$845	$1,633	NA	United Kingdom $989; Belgium-Luxembourg $451; Netherlands $106.
Waste and sweepings do	$1,805	$2,165	$125	Belgium-Luxembourg $1,207; Netherlands $278; United Kingdom $222.
Metal including alloys, unwrought and partly wrought: thousand troy ounces	47,772	31,158	726	Austria 3,118; Italy 2,997; Sweden 2,616.
Tellurium, elemental and arsenic	17	16	4	Austria 5; United Kingdom 4.
Tin:				
Ore and concentrate	110	138	—	Netherlands 80; Mexico 58.
Ash and residue containing tin	2,306	2,381	140	United Kingdom 1,992; Belgium-Luxembourg 189.
Metal including alloys:				
Scrap	87	123	—	Netherlands 83; Belgium-Luxembourg 22; United Kingdom 13.
Unwrought	3,788	3,468	503	United Kingdom 518; Netherlands 490.
Semimanufactures	1,519	1,276	6	Austria 191; Switzerland 147; unspecified 431.
Titanium:				
Ore and concentrate	15,076	5,064	2	Hungary 3,471; Bulgaria 398; France 351.
Oxides	71,021	56,106	15,398	Taiwan 5,079; Italy 4,124; Canada 3,733.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
METALS —Continued				
Titanium —Continued				
Metal including alloys:				
Scrap	811	644	80	United Kingdom 378; France 81.
Unwrought	56	50	17	Netherlands 15; Italy 5.
Semimanufactures	1,003	558	15	France 112; United Kingdom 65; Italy 60.
Tungsten:				
Ore and concentrate	2	—	—	
Oxides and hydroxides	NA	192	3	Austria 101; Japan 26; Romania 20.
Ash and residue containing tungsten	251	146	—	Austria 124; Netherlands 17; Belgium-Luxembourg 5.
Metal including alloys:				
Scrap	542	716	10	Austria 311; Sweden 279; Belgium-Luxembourg 45.
Unwrought	581	376	NA	NA.
Semimanufactures	199	150	4	Austria 16; Italy 15; France 14.
Uranium and thorium:				
Ore and concentrate	(3)	3,297	—	All to Czechoslovakia.
Oxides and other compounds	833	382	—	France 363; Belgium-Luxembourg 19.
Metal including alloys, all forms:				
Uranium	2	8	—	Canada 4; Italy 4.
Thorium	(3)	(3)	—	All to Greece.
Vanadium:				
Oxides and hydroxides	NA	700	NA	NA.
Ash and residue containing vanadium	4,296	2,735	—	Belgium-Luxembourg 2,475; Italy 199; United Kingdom 36.
Metal including alloys:				
Scrap	—	(3)	—	All to Japan.
Unwrought	393	209	(3)	United Kingdom 109; Japan 61; France 36.
Semimanufactures	(3)	(3)	—	All to Bulgaria.
Zinc:				
Ore and concentrate	203,876	96,609	—	Netherlands 32,992; Belgium-Luxembourg 29,020; France 26,563.
Oxides	17,128	22,794	NA	NA.
Blue powder	8,050	6,929	NA	Netherlands 1,335; Switzerland 1,061; United Kingdom 1,003.
Matte	12,657	6,994	—	Italy 2,798; Netherlands 2,324; Belgium-Luxembourg 555.
Ash and residue containing zinc	81,577	77,492	—	Sweden 31,617; Belgium-Luxembourg 16,685; United Kingdom 8,658.
Metal including alloys:				
Scrap	16,181	18,328	—	Netherlands 6,826; Italy 2,115; unspecified 6,872.
Unwrought	133,156	102,202	1,001	Italy 27,158; France 21,172; Belgium-Luxembourg 11,124.
Semimanufactures	22,511	21,060	NA	NA.
Zirconium:				
Ore and concentrate	15,051	15,621	—	Poland 2,542; France 2,500; Czechoslovakia 1,908.
Metal including alloys:				
Scrap	42	82	19	France 35; United Kingdom 22.
Unwrought	25	16	1	Netherlands 4; Sweden 4; United Kingdom 2.
Semimanufactures	21	6	(3)	Austria 2; Switzerland 2; France 1.
Other:				
Ores and concentrates	47	—	—	
Oxides and hydroxides	6,801	710	3	Italy 250; Czechoslovakia 107; Spain 101.
Ashes and residues	147,027	122,343	119	Belgium-Luxembourg 63,169; France 52,698; Netherlands 4,131.
Base metals including alloys, all forms	19,993	246	10	Romania 92; Belgium-Luxembourg 40; United Kingdom 34.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	364,412	303,545	73	Netherlands 281,508; Switzerland 9,199; Belgium-Luxembourg 9,018.
Artificial:				
Corundum	58,757	54,996	3,253	Italy 7,861; France 5,634; United Kingdom 5,438.
Silicon carbide	33,373	27,074	NA	NA.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Abrasives, n.e.s. —Continued				
Dust and powder of precious and semiprecious stones including diamond kilograms	1,944	8,094	156	Switzerland 2,536; France 1,371; Greece 1,326.
Grinding and polishing wheels and stones	17,334	17,398	1,387	France 2,151; Netherlands 1,478; United Kingdom 1,242.
Asbestos, crude	3,065	777	NA	NA.
Barite and witherite	55,988	38,822	311	France 10,742; Belgium-Luxembourg 7,171; Sweden 6,243.
Boron materials:				
Crude natural borates	5,895	2,201	—	Sweden 2,016; Yugoslavia 70; Belgium-Luxembourg 32.
Elemental	11	11	5	France 3; Sweden 1.
Oxides and acids	794	564	NA	Czechslovakia 91; Yugoslavia 65; Colombia 42.
Bromine	6	3	(3)	Republic of South Africa 1.
Cement thousand tons	2,189	2,079	1	Netherlands 1,580; Belgium-Luxembourg 111; Nigeria 99.
Chalk	88,270	81,843	65	Finland 44,940; Netherlands 15,086; Sweden 9,971.
Clays, crude:				
Bentonite	34,444	32,943	19	Belgium-Luxembourg 8,442; France 7,129; Austria 5,933.
Ceramic	1,170,660	1,294,775	NA	Italy 795,660; France 177,009; Netherlands 158,993.
Chamotte earth	27,540	29,364	—	Netherlands 12,865; Austria 3,903; Italy 3,605.
Fire clay	183,388	154,576	NA	Netherlands 89,562; Italy 22,239; Austria 17,490.
Fuller's earth	4,118	3,867	—	France 1,183; Belgium-Luxembourg 694; United Kingdom 194.
Kaolin	104,302	117,176	72	Italy 29,488; Austria 18,085; Switzerland 17,617.
Unspecified	r258,032	499,548	NA	Netherlands 335,785; Belgium-Luxembourg 106,522; France 24,259.
Cryolite and chiolite	298	182	—	Italy 174; Denmark 4; Greece 3.
Diamond:				
Gem, not set or strung carats	127,319	174,279	5,961	Belgium-Luxembourg 54,055; United Kingdom 30,328; Switzerland 21,988.
Industrial stones do	452,387	236,027	55,168	Ireland 75,516; Switzerland 23,729.
Diatomite and other infusorial earth	1,510	1,247	7	France 304; Belgium-Luxembourg 171; Austria 148.
Feldspar, fluorspar, related materials:				
Feldspar	20,313	26,313	33	France 13,206; Netherlands 5,404; Belgium-Luxembourg 3,679.
Fluorspar	15,833	13,100	23	Austria 6,676; France 3,585; Belgium-Luxembourg 698.
Unspecified	1,190	644	14	Belgium-Luxembourg 476; Netherlands 96; Austria 26.
Fertilizer materials:				
Crude, n.e.s.	110,774	107,895	—	Netherlands 91,603; Switzerland 4,464; Italy 2,954.
Manufactured:				
Ammonia thousand tons	334	202	NA	Denmark 110; Norway 18; Sweden 14.
Nitrogenous do	1,541	1,450	2	Belgium-Luxembourg 418; Netherlands 267; France 133.
Phosphatic do	114	86	—	Netherlands 33; Austria 26; France 14.
Potassic do	2,333	2,177	58	Belgium-Luxembourg 503; India 260; Ireland 145.
Unspecified and mixed do	862	960	(3)	Belgium-Luxembourg 317; France 97; Italy 89.
Graphite, natural	11,522	9,130	511	Italy 1,675; Spain 932; Austria 741.
Gypsum and plaster	274,615	279,902	—	Netherlands 85,369; Belgium-Luxembourg 50,937; Switzerland 38,706.
Iodine	64	47	(3)	United Kingdom 8; Denmark 7; Italy 6.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Kyanite and related materials	8,013	7,470	393	Austria 1,327; France 1,307; United Kingdom 890.
Lime	421,442	459,687	—	Netherlands 283,829; France 66,675; Switzerland 42,914.
Magnesium compounds:				
Magnesite, crude	24	22	—	Belgium-Luxembourg 15; Australia 5; France 1.
Oxides and hydroxides	30,271	39,694	387	France 22,967; Italy 2,763; Netherlands 2,483.
Other	444,732	371,813	15,315	France 85,122; Norway 42,337; Belgium-Luxembourg 34,228.
Mica:				
Crude including splittings and waste	1,447	1,365	34	Netherlands 325; Spain 206; Yugoslavia 135.
Worked including agglomerated splittings	220	283	3	Italy 68; United Kingdom 46; Hong Kong 41.
Phosphates, crude	9,824	2,482	—	Switzerland 1,727; Belgium-Luxembourg 390; Netherlands 304.
Phosphorus, elemental	2,299	NA		
Pigments, mineral:				
Natural, crude	1,598	1,158	506	Switzerland 603; France 64.
Iron oxides and hydroxides, processed	166,495	143,698	NA	NA.
Potassium salts, crude	50,906	43,401	—	Belgium-Luxembourg 20,936; United Kingdom 17,780; Netherlands 3,339.
Precious and semiprecious stones other than diamond:				
Natural	338	302	18	China 88; Hong Kong 47; India 37.
Synthetic	20	45	3	Japan 14; Switzerland 9; Italy 3.
Pyrite, unroasted	1,217	1,290	NA	NA.
Quartz crystal, piezoelectric:				
kilograms	183	147	NA	France 30.
Salt and brine: thousand tons	2,360	2,291	(3)	Belgium-Luxembourg 1,405; Sweden 333; United Kingdom 120.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	407,343	432,075	28	Belgium-Luxembourg 231,474; Netherlands 48,131; Sweden 25,752.
Sulfate, manufactured	73,104	74,306	NA	Italy 19,971; Netherlands 16,387; Switzerland 10,015.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked: thousand tons	691	637	(3)	Netherlands 533; Switzerland 60; Italy 11.
Worked: do.	41	46	1	Austria 10; Belgium-Luxembourg 8; Switzerland 8.
Dolomite, chiefly refractory-grade: do.	112	103	(3)	Netherlands 29; Belgium-Luxembourg 24; France 13.
Gravel and crushed rock: do.	8,965	11,269	(3)	Netherlands 8,820; Switzerland 1,412; Belgium-Luxembourg 654.
Limestone other than dimension: do.	86	86	(3)	Netherlands 74; Belgium-Luxembourg 8; Switzerland 2.
Quartz and quartzite: do.	90	56	(3)	Austria 14; Belgium-Luxembourg 10; Italy 9.
Sand other than metal-bearing: do.	6,358	7,503	(3)	Netherlands 5,362; Belgium-Luxembourg 1,231; Switzerland 546.
Sulfur:				
Elemental:				
Crude including native and byproduct	671,952	686,040	22	Netherlands 297,992; Switzerland 45,593; Denmark 42,842.
Colloidal, precipitated, sublimed	502	361	NA	Belgium-Luxembourg 217; France 38.
Dioxide	27,899	22,373	—	Austria 10,303; Netherlands 6,653; Belgium-Luxembourg 3,057.
Sulfuric acid	660,988	732,863	55,955	Netherlands 231,435; Belgium-Luxembourg 208,042; United Kingdom 117,753.
Talc, steatite, soapstone, pyrophyllite	8,534	7,397	5	Netherlands 4,387; Yugoslavia 1,126; Switzerland 388.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Destinations, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Vermiculite, perlite, chlorite	6,885	7,318	35	Belgium-Luxembourg 4,210; Netherlands 1,685; Switzerland 801.
Other:				
Crude thousand tons	2,115	2,189	(3)	Netherlands 1,600; Belgium-Luxembourg 310; France 150.
Slag and dross, not metal-bearing do	3,593	4,038	12	Netherlands 2,904; France 915; Belgium-Luxembourg 79.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	6,228	5,431	--	Austria 2,269; Belgium-Luxembourg 1,592; Sweden 593.
Carbon:				
Carbon black	31,211	6,374	465	United Kingdom 908; Austria 885; France 867.
Gas carbon	126,934	122,519	2,102	France 40,405; Austria 16,845; Belgium-Luxembourg 9,682.
Coal:				
Anthracite and bituminous thousand tons	8,957	6,701	--	France 2,245; Belgium-Luxembourg 1,582; Italy 1,776.
Briquets of anthracite and bituminous coal do	668	475	--	United Kingdom 202; France 115; Belgium-Luxembourg 80.
Lignite including briquets do	1,074	924	--	Belgium-Luxembourg 298; Austria 212; Netherlands 112.
Coke and semicoke do	5,504	3,391	(3)	Belgium-Luxembourg 1,560; France 832; Netherlands 187.
Gas, natural: Gaseous million cubic feet	256,358	48,795	--	NA.
Peat including briquets and litter thousand tons	1,066	1,249	(3)	Netherlands 690; France 184; Italy 90.
Petroleum:				
Crude thousand 42-gallon barrels	8,805	(3)	--	Mainly to Netherlands.
Refinery products:				
Liquefied petroleum gas do	5,655	4,874	--	Netherlands 2,266; Italy 1,056; Austria 456.
Gasoline do	12,240	9,364	168	Switzerland 4,365; Austria 1,339; Netherlands 1,275.
Mineral jelly and wax do	1,385	1,412	--	Netherlands 236; Republic of South Africa 114; Belgium-Luxembourg 82.
Kerosene and jet fuel do	10,674	10,808	161	Switzerland 238; Netherlands 204; bunkers 10,028.
Distillate fuel oil do	8,760	6,858	2	Switzerland 3,029; France 1,171; Austria 648.
Lubricants do	3,873	3,122	24	Belgium-Luxembourg 459; United Kingdom 391; Sweden 240.
Residual fuel oil do	15,640	13,311	--	Austria 2,670; Belgium-Luxembourg 1,644; bunkers 6,121.
Bitumen and other residues do	2,760	2,849	(3)	Austria 749; Switzerland 714; Denmark 388.
Bituminous mixtures do	126	137	(3)	Netherlands 40; Switzerland 32; Austria 18.
Petroleum coke do	2,157	1,585	--	France 358; Netherlands 327; Austria 316.
Unspecified do	6	--	--	

[r]Revised. NA Not available.
[1]Table prepared by Jozef Plachy.
[2]Excludes trade with East Germany.
[3]Less than 1/2 unit.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals:				
Alkali metals	1,374	1,877	(3)	France 858; Netherlands 3; unspecified 1,015.
Alkaline-earth metals	547	544	15	France 209; U.S.S.R. 150; China 67.
Aluminum:				
Ore and concentrate ... thousand tons	4,034	3,659	(3)	Australia 1,287; Guinea 1,108; Sierra Leone 867.
Oxides and hydroxides	664,738	721,698	3,021	Australia 266,771; Italy 170,972; Ireland 122,308.
Ash and residue containing aluminum	74,629	46,234	18	Netherlands 16,522; U.S.S.R. 7,217; Austria 5,521.
Metal including alloys:				
Scrap	202,882	215,151	4,813	Netherlands 49,854; United Kingdom 43,664; France 25,162.
Unwrought	721,618	764,332	6,863	Norway 227,764; United Kingdom 65,673; Netherlands 62,959.
Semimanufactures	331,329	345,138	2,024	France 79,960; Belgium-Luxembourg 49,560; Netherlands 48,367.
Antimony:				
Ore and concentrate	1,630	1,845	—	China 1,010; Bolivia 805; Chile 30.
Oxides	4,866	4,581	44	Belgium-Luxembourg 1,313; France 1,134; China 1,102.
Metal including alloys, all forms	783	977	5	China 341; Turkey 300; U.S.S.R. 157.
Arsenic: Oxides and acids	328	345	—	Belgium-Luxembourg 205; France 98; Sweden 19.
Beryllium:				
Oxides and hydroxides	(3)	(3)	—	Mainly from United Kingdom.
Metal including alloys, all forms	2	5	2	United Kingdom 3.
Bismuth: Metal including alloys, all forms	385	434	2	Peru 72; United Kingdom 58; Japan 27.
Cadmium:				
Oxides and hydroxides	532	556	—	Belgium-Luxembourg 512; France 32.
Metal including alloys, all forms	546	531	(3)	Belgium-Luxembourg 127; Netherlands 100; Canada 65.
Cesium and rubidium: Metal including alloys, all forms	(3)	(3)	(3)	
Chromium:				
Ore and concentrate	384,473	275,307	—	Republic of South Africa 188,452; Turkey 39,068; Albania 23,022.
Oxides and hydroxides	1,893	2,744	19	China 1,511; Poland 382; United Kingdom 243.
Metal including alloys, all forms	1,460	1,180	44	United Kingdom 375; France 291; Japan 214.
Cobalt:				
Ore and concentrate	5	—	—	
Oxides and hydroxides	441	374	1	Belgium-Luxembourg 188; Finland 106; United Kingdom 42.
Metal including alloys, all forms	2,122	2,849	57	Zaire 1,788; Zambia 321; Canada 184.
Columbium and tantalum:				
Ore and concentrate	506	1,089	NA	NA.
Ash and residue containing columbium and/or tantalum	3,998	2,078	143	Thailand 687; Zimbabwe 421; Spain 359.
Metal including alloys, all forms:				
Columbium (niobium)	34	24	21	Japan 1.
Tantalum	173	148	107	Austria 9; Belgium-Luxembourg 9.
Copper:				
Ore and concentrate	549,081	581,423	5,320	Papua New Guinea 213,097; Mexico 128,000; Chile 86,098.
Matte and speiss including cement copper	7,086	8,543	—	Spain 4,020; France 2,995; Cyprus 720.
Oxides and hydroxides	1,310	1,585	58	Belgium-Luxembourg 811; Italy 643.
Sulfate	10,215	10,474	2	Belgium-Luxembourg 1,887; France 1,672; Poland 1,605.
Ash and residue containing copper	25,141	19,378	735	Italy 4,354; Switzerland 3,177; Netherlands 3,118.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Copper —Continued				
Metal including alloys:				
Scrap	269,855	248,067	19,110	United Kingdom 47,272; France 45,044; Netherlands 34,467.
Unwrought	562,045	545,829	5,656	Chile 135,506; Poland 85,061; Zaire 78,289.
Semimanufactures	300,088	270,488	1,149	Belgium-Luxembourg 98,902; France 76,718; Italy 22,747.
Gallium: Metal including alloys, all forms	17	14	5	Belgium-Luxembourg 3; France 3.
Germanium: Metal including alloys, all forms	6	13	(3)	China 5; United Kingdom 4; Belgium-Luxembourg 3.
Gold:				
Ash and residue containing gold value, thousands	$13,349	$21,942	$15,656	Switzerland $2,578; Chile $1,370.
Waste and sweepings do.	$26,744	$54,312	—	Singapore $7,179; Sweden $5,021; Belgium-Luxembourg $3,711.
Metal including alloys, unwrought and partly wrought thousand troy ounces	2,673	3,225	8	United Kingdom 537; Republic of South Africa 514; Switzerland 335.
Hafnium: Metal including alloys, all forms	(3)	1	(3)	Mainly from France.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite thousand tons	45,007	41,632	(3)	Brazil 15,640; Canada 6,414; Liberia 5,930.
Pyrite, roasted do.	76	78	—	Belgium-Luxembourg 33; Sweden 28; Norway 16.
Metal:				
Scrap do.	1,836	1,376	9	Netherlands 414; France 262; United Kingdom 167.
Pig iron, cast iron, related materials	268,929	327,593	325	Brazil 104,702; Canada 77,176; France 33,948.
Ferroalloys:				
Ferrochromium	287,300	272,458	19	Republic of South Africa 145,615; Zimbabwe 34,313; Netherlands 27,225.
Ferromanganese	129,854	106,140	409	France 46,526; Norway 28,911; Republic of South Africa 13,520.
Ferromolybdenum	5,795	5,769	56	Belgium-Luxembourg 2,457; United Kingdom 1,413; Netherlands 687.
Ferronickel	101,491	88,157	28	Greece 38,555; New Caledonia 22,079; Dominican Republic 6,487.
Ferrosilicochromium	17,793	16,545	—	Zimbabwe 14,248; Sweden 1,857; Italy 94.
Ferrosilicomanganese	123,253	111,817	3,044	Norway 55,326; Republic of South Africa 19,995; Czechoslovakia 10,531.
Ferrosilicon	220,079	206,340	2,096	Norway 98,675; France 21,208; Yugoslavia 7,182.
Silicon metal	68,842	66,791	2	Norway 28,528; France 10,347; Switzerland 5,692.
Unspecified	18,957	17,767	62	France 4,161; Brazil 2,884; United Kingdom 2,148.
Steel, primary forms thousand tons	2,403	2,017	6	Belgium-Luxembourg 627; Netherlands 262; United Kingdom 242.
Semimanufactures:				
Bars, rods, angles, shapes, sections do.	4,019	4,159	4	Italy 845; Belgium-Luxembourg 766; France 538.
Universals, plates, sheets do.	3,895	4,005	4	Belgium-Luxembourg 992; France 730; Austria 394.
Hoop and strip do.	663	701	1	Belgium-Luxembourg 257; France 178; Austria 67.
Rails and accessories do.	17	14	(3)	Netherlands 5; Poland 3; Austria 2.
Wire do.	311	309	(3)	Belgium-Luxembourg 91; France 56; Italy 39.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Tubes, pipes, fittings thousand tons	976	987	1	Italy 274; France 149; Netherlands 114.
Castings and forgings, rough do.	72	57	(3)	France 9; Netherlands 7; Denmark 6.
Lead:				
Ore and concentrate	236,490	194,054	—	Sweden 35,011; Canada 34,406; Australia 30,150.
Oxides	9,212	10,577	18	Belgium-Luxembourg 4,149; United Kingdom 1,947; France 325.
Ash and residue containing lead	45,133	30,483	823	Australia 11,353; France 8,990; Tunisia 2,612.
Metal including alloys:				
Scrap	45,905	50,542	30	Czechoslovakia 8,625; Denmark 8,297; Netherlands 6,501.
Unwrought	135,139	143,420	5,543	United Kingdom 56,655; Belgium-Luxembourg 19,279; Netherlands 16,298.
Semimanufactures	3,705	4,397	15	Belgium-Luxembourg 3,167; United Kingdom 547; Netherlands 285.
Lithium:				
Oxides and hydroxides	687	1,608	311	Switzerland 886; China 298.
Metal including alloys, all forms	22	24	2	United Kingdom 17; France 2; Hungary 2.
Magnesium: Metal including alloys:				
Scrap	3,901	5,229	80	Belgium-Luxembourg 1,956; Netherlands 772; Sweden 437.
Unwrought	26,944	27,710	5,034	Norway 15,882; France 2,496.
Semimanufactures	1,634	3,261	26	Austria 1,438; Turkey 822; Belgium-Luxembourg 521.
Manganese:				
Ore and concentrate, metallurgical-grade	377,795	473,126	—	Republic of South Africa 235,376; Australia 131,915; Brazil 47,876.
Oxides	5,601	5,261	9	Japan 2,315; Belgium-Luxembourg 1,953; Greece 519.
Metal including alloys, all forms	6,225	6,343	403	Republic of South Africa 3,311; Belgium-Luxembourg 997; France 852.
Mercury 76-pound flasks	11,687	11,960	NA	Spain 4,814; Algeria 3,103; U.S.S.R. 1,827.
Molybdenum:				
Ore and concentrate	17,600	17,817	3,131	Chile 4,523; Belgium-Luxembourg 3,844.
Oxides and hydroxides	174	120	23	Netherlands 26; Chile 13.
Metal including alloys:				
Scrap	472	553	52	Austria 331; United Kingdom 41.
Unwrought	270	119	37	United Kingdom 40; France 35.
Semimanufactures	403	360	107	Austria 207; United Kingdom 17.
Nickel:				
Ore and concentrate	24	5	—	All from Belgium-Luxembourg.
Matte and speiss	12,583	11,180	—	Australia 10,571; Canada 565; Cuba 50.
Oxides and hydroxides	234	558	(3)	Australia 317; Canada 115; Netherlands 39.
Ash and residue containing nickel	2,099	1,702	55	Belgium-Luxembourg 415; Netherlands 397; United Kingdom 141.
Metal including alloys:				
Scrap	7,561	8,062	1,756	France 1,817; Netherlands 663.
Unwrought	42,368	47,148	733	U.S.S.R. 15,469; Norway 5,880; Canada 5,686.
Semimanufactures	8,766	6,919	721	France 3,209; United Kingdom 1,442.
Platinum-group metals:				
Ash and residue containing platinum value, thousands	$7,927	$10,928	$5,022	United Kingdom $1,504; Finland $1,180.
Waste and sweepings do.	$31,684	$46,955	$3,802	Netherlands $9,831; Belgium-Luxembourg $6,590; Hungary $4,078.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Platinum-group metals —Continued				
Metals including alloys, unwrought and partly wrought:				
Palladium troy ounces	621,575	582,222	45,494	U.S.S.R. 222,614; United Kingdom 133,394; Czechoslovakia 60,958.
Platinum do	621,222	570,680	41,236	Switzerland 150,242; United Kingdom 135,677; Republic of South Africa 63,241.
Unspecified do	155,632	174,387	59,639	Republic of South Africa 59,335; United Kingdom 32,950.
Rare-earth metals including alloys, all forms	107	113	4	Austria 77; United Kingdom 13; Brazil 10.
Rhenium: Metal including alloys, all forms	(3)	(3)	NA	Mainly from U.S.S.R.
Selenium, elemental and phosphorus	28,468	25,384	NA	NA.
Silicon, high-purity	44	31	2	United Kingdom 9; Sweden 7; France 6.
Silver:				
Ash and residue containing silver value, thousands	$62,604	$49,935	$31,442	Canada $4,476; Chile $2,688.
Waste and sweepings do	$30,315	$24,475	$13,174	Netherlands $2,251; Mexico $1,866.
Metal including alloys, unwrought and partly wrought thousand troy ounces	35,442	42,303	3,094	United Kingdom 14,433; Sweden 4,592; Switzerland 4,503.
Tellurium, elemental and arsenic	74	103	(3)	Sweden 24; United Kingdom 24; Belgium-Luxembourg 21.
Tin:				
Ore and concentrate	2,351	504	—	Bolivia 415; Zaire 72; United Kingdom 10.
Oxides	42	41	1	United Kingdom 32; Italy 5; Netherlands 3.
Ash and residue containing tin	8,247	4,874	1,468	Netherlands 1,227; United Kingdom 943.
Metal including alloys:				
Scrap	224	303	16	Netherlands 107; United Kingdom 41; Austria 40.
Unwrought	19,138	18,825	188	Indonesia 3,403; United Kingdom 2,563; Thailand 2,297.
Semimanufactures	194	62	1	United Kingdom 30; Netherlands 14; Norway 5.
Titanium:				
Ore and concentrate	486,362	450,604	18	Norway 257,157; Netherlands 71,658; Sri Lanka 39,471.
Oxides	16,980	17,806	1,312	Belgium-Luxembourg 6,300; France 4,909; United Kingdom 2,555.
Metal including alloys:				
Scrap	886	555	61	Japan 321; United Kingdom 69.
Unwrought	2,269	1,609	309	Japan 857; U.S.S.R. 423.
Semimanufactures	836	738	197	Japan 244; United Kingdom 221.
Tungsten:				
Ore and concentrate	3,843	3,184	2	Canada 696; China 675; Sweden 393.
Oxides and hydroxides	3	32	1	China 30.
Ash and residue containing tungsten	803	337	42	Sweden 105; United Kingdom 95; Netherlands 48.
Metal including alloys:				
Scrap	483	486	15	Austria 103; France 84; Netherlands 58.
Unwrought	728	603	12	Austria 461; Republic of Korea 37; France 30.
Semimanufactures	103	105	20	Austria 50; Netherlands 10.
Uranium and/or thorium:				
Oxides and other compounds	3	—		
Metal including alloys, all forms:				
Uranium	(3)	12	10	Canada 1; United Kingdom 1.
Thorium	(3)	(3)	NA	Mainly from Netherlands.
Vanadium:				
Oxides and hydroxides	1,870	1,806	(3)	China 1,330; Finland 467; Netherlands 50.
Ash and residue containing vanadium	31,635	1,911	63	Italy 709; U.S.S.R. 412; Israel 275.
Metal including alloys:				
Scrap	(3)	—		
Unwrought	(3)	(3)	(3)	
Semimanufactures	267	66	60	France 6.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Ore and concentrate	592,709	620,810	—	Canada 199,139; Australia 119,069; Peru 87,523.
Oxides	13,986	12,769	56	Netherlands 3,499; France 2,675; Belgium-Luxembourg 1,876.
Blue powder	12,394	13,032	—	Belgium-Luxembourg 10,108; France 1,827; Norway 1,030.
Matte	9,668	10,919	577	Netherlands 4,010; Belgium-Luxembourg 1,681; France 1,542.
Ash and residue containing zinc	58,981	48,298	1,637	United Kingdom 7,629; Netherlands 4,936; Italy 4,614.
Metal including alloys:				
Scrap	19,823	15,514	21	Netherlands 4,581; Italy 2,883; Belgium-Luxembourg 1,602.
Unwrought	167,813	174,214	1	Belgium-Luxembourg 62,331; Netherlands 41,666; France 24,068.
Semimanufactures	23,653	28,951	28	France 18,023; Netherlands 3,527; Yugoslavia 3,234.
Zirconium:				
Ore and concentrate	78,929	83,002	5,786	Australia 38,153; Republic of South Africa 28,296.
Metal including alloys:				
Scrap	20	22	7	Italy 9; Belgium-Luxembourg 3.
Unwrought	6	9	1	France 3; Belgium-Luxembourg 2; U.S.S.R. 2.
Semimanufactures	463	364	156	France 146; Sweden 60.
Other:				
Ores and concentrates	20	—	—	
Ore and concentrate of precious metals value, thousands	$42,132	$43,425	$12,238	Chile $17,611; Canada $7,078.
Oxides and hydroxides	504	565	28	United Kingdom 227; France 187; Brazil 96.
Ashes and residues	250,860	233,274	892	Canada 155,728; France 466; unspecified 73,590.
Base metals including alloys, all forms	7,297	1,015	467	Austria 114; United Kingdom 59.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	46,504	82,914	661	Greece 63,920; Iceland 9,989; Italy 5,988.
Artificial:				
Corundum	30,644	31,953	686	Austria 5,781; U.S.S.R. 5,067; Yugoslavia 4,151.
Silicon carbide	80,915	67,719	1	Norway 14,842; Italy 2,624; unspecified 42,486.
Dust and powder of precious and semi-precious stones including diamond	433	334	330	Ireland 2.
Grinding and polishing wheels and stones	9,981	8,855	63	Austria 2,339; Netherlands 1,653; Italy 1,579.
Asbestos, crude	63,171	64,943	1,602	Canada 36,259; Italy 14,839; U.S.S.R. 4,102.
Barite and witherite	221,624	198,558	—	France 96,602; China 32,222; Belgium-Luxembourg 26,256.
Boron materials:				
Crude natural borates	58,664	54,634	143	Turkey 53,720; Netherlands 650.
Elemental	(3)	(3)	(3)	
Oxides and acids	22,063	23,793	918	France 9,091; Turkey 6,536; Italy 4,405.
Bromine	7,443	6,071	35	Israel 4,818; United Kingdom 933; France 136.
Cement thousand tons	1,775	1,296	(3)	Belgium-Luxembourg 516; France 336; Netherlands 142.
Chalk	242,897	270,687	15	France 205,488; Belgium-Luxembourg 55,681; United Kingdom 3,522.
Clays, crude:				
Bentonite	114,610	116,903	11,587	Greece 54,225; Turkey 19,001; Spain 15,975.
Ceramic	69,508	54,713	NA	France 30,013; Czechoslovakia 12,602; United Kingdom 10,145.
Chamotte earth	26,172	24,560	2,142	France 11,125; Republic of South Africa 4,925; Czechoslovakia 4,070.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Clays, crude —Continued				
Fire clay	100,369	98,390	10,791	Czechoslovakia 39,132; France 33,392.
Fuller's earth	6,905	9,769	1,425	United Kingdom 6,749; Spain 1,233.
Kaolin	871,793	828,690	100,332	United Kingdom 419,303; Czechoslovakia 143,915.
Unspecified	r119,941	133,504	6,768	Netherlands 64,703; Czechoslovakia 39,749; France 10,952.
Cryolite and chiolite	1,744	1,422	(3)	Greenland 1,421.
Diamond:				
Gem, not set or strung thousand carats	422	490	5	Belgium-Luxembourg 172; U.S.S.R. 130; India 95.
Industrial stones do.	1,167	1,182	106	Belgium-Luxembourg 361; Republic of South Africa 294; United Kingdom 149.
Diatomite and other infusorial earth	39,161	38,856	2,005	Denmark 22,044; France 10,250.
Feldspar, fluorspar, related materials:				
Feldspar	46,213	55,193	30	Norway 19,338; Italy 14,978; Finland 11,269.
Fluorspar	233,280	192,543	--	Republic of South Africa 70,225; China 27,077; Morocco 21,502.
Unspecified	64,473	72,781	--	Norway 63,445; Netherlands 9,025; Belgium-Luxembourg 186.
Fertilizer materials:				
Crude, n.e.s	31,199	36,548	1,046	Netherlands 27,230; France 2,804; Peru 1,508.
Manufactured:				
Ammonia thousand tons	497	385	(3)	Netherlands 248; France 98; Austria 14.
Nitrogenous do.	3,208	2,385	16	Netherlands 766; Belgium-Luxembourg 396; Austria 264.
Phosphatic do.	711	611	(3)	Belgium-Luxembourg 430; France 81; Netherlands 40.
Potassic do.	76	65	(3)	France 58; Canada 4; Belgium-Luxembourg 2.
Unspecified and mixed do.	1,472	1,401	188	Netherlands 214; Belgium-Luxembourg 155.
Graphite, natural	33,998	37,793	48	China 17,848; Austria 3,612; unspecified 12,105.
Gypsum and plaster	876,859	823,827	144	France 690,389; Austria 116,818; Belgium-Luxembourg 13,427.
Iodine	1,880	1,704	36	Japan 844; Chile 780.
Kyanite and related materials	110,172	80,376	35,924	Republic of South Africa 34,192; France 3,961.
Lime	356,393	332,211	--	France 202,839; Belgium-Luxembourg 46,337; Poland 46,313.
Magnesium compounds:				
Magnesite, crude	6,242	4,918	--	Greece 3,005; Netherlands 671; Spain 576.
Oxides and hydroxides	394,558	414,131	1,104	China 87,403; Greece 59,915; Netherlands 45,956.
Other	2	123	--	Netherlands 100; Austria 23.
Mica:				
Crude including splittings and waste	11,946	11,468	168	India 4,571; China 2,494; France 1,872.
Worked including agglomerated splittings	645	757	20	Belgium-Luxembourg 323; France 229.
Nitrates, crude	2,346	3,345	--	All from Chile.
Phosphates, crude thousand tons	1,943	1,579	718	Republic of South Africa 257; Morocco 224.
Pigments, mineral:				
Natural, crude	296	119	--	Cyprus 54; Netherlands 41; France 17.
Iron oxides and hydroxides, processed	32,765	28,154	--	Belgium-Luxembourg 2,543; Netherlands 1,789; France 1,502
Potassium salts, crude	10,086	203	--	Belgium-Luxembourg 104; Netherlands 99.
Precious and semiprecious stones other than diamond:				
Natural	841	797	25	Brazil 324; Republic of South Africa 180; India 39.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
INDUSTRIAL MINERALS —Continued				
Precious and semiprecious stones other than diamond —Continued				
Synthetic	30	27	5	Switzerland 10; Bulgaria 7.
Pyrite, unroasted	187,042	203,328	--	Finland 106,808; Yugoslavia 87,368; Norway 5,921.
Quartz crystal, piezoelectric kilograms	50	47	NA	NA.
Salt and brine	826,942	652,640	33	Netherlands 484,078; France 120,878; Italy 39,335.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	151,084	105,562	3	Netherlands 54,662; Czechoslovakia 9,603; unspecified 25,742.
Sulfate, manufactured	91,290	70,188	NA	Austria 21,115; Spain 20,347; Belgium-Luxembourg 12,554.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked thousand tons	772	936	(3)	Norway 252; Sweden 235; Austria 110.
Worked do	858	1,000	(3)	Italy 452; Portugal 254; Austria 56.
Dolomite, chiefly refractory-grade do	332	373	--	Belgium-Luxembourg 333; Norway 14; Austria 13.
Gravel and crushed rock do	8,417	8,174	(3)	France 4,866; Denmark 861; Norway 770.
Limestone other than dimension do	1,418	1,355	(3)	Austria 601; France 438; Belgium-Luxembourg 237.
Quartz and quartzite do	69	71	2	Netherlands 20; Belgium-Luxembourg 15; Yugoslavia 14.
Sand other than metal-bearing do	2,873	3,578	1	France 2,040; Netherlands 878; Belgium-Luxembourg 193.
Sand and gravel do	2,411	--	--	--
Sulfur:				
Elemental:				
Crude including native and byproduct	252,801	232,640	43,519	Canada 158,766; Poland 23,953.
Colloidal, precipitated, sublimed	733	1,622	3	Netherlands 964; France 655.
Dioxide	7,254	9,430	(3)	Sweden 4,708; Poland 3,773; Switzerland 505.
Sulfuric acid	177,213	118,312	--	Netherlands 100,942; Switzerland 15,910; Austria 870.
Talc, steatite, soapstone, pyrophyllite	139,082	148,300	920	Austria 57,819; France 32,666; Italy 12,527.
Vermiculite, perlite, chlorite	97,641	108,125	149	Greece 75,386; Republic of South Africa 12,658; Hungary 11,921.
Other:				
Crude thousand tons	1,505	1,521	9	Norway 508; Netherlands 285; Austria 189.
Slag and dross, not metal-bearing do	1,556	1,394	6	Belgium-Luxembourg 518; France 502; Austria 92.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	20,275	21,617	8,168	Trinidad and Tobago 11,763; Albania 658.
Carbon:				
Carbon black	2,680	2,850	1	Netherlands 2,554; United Kingdom 596; France 346.
Gas carbon	60,159	64,554	2,473	France 21,776; Netherlands 18,923; Spain 5,397.
Coal:				
Anthracite thousand tons	33	39	(3)	United Kingdom 16; Republic of South Africa 7; Norway 5.
Bituminous do	9,828	9,967	398	Republic of South Africa 4,067; Poland 2,637; Australia 832.
Briquets of anthracite and bituminous coal do	1	2	--	Mainly from Netherlands.
Lignite including briquets do	4,023	2,493	--	Czechoslovakia 2,485; Austria 5; Yugoslavia 1.
Coke and semicoke do	1,012	949	108	Belgium-Luxembourg 242; Netherlands 135; United Kingdom 125.
Gas, natural: Gaseous million cubic feet	1,873,310	1,590,212	NA	NA.
Peat including briquets and litter	103,948	101,572	9	Netherlands 64,301; U.S.S.R. 32,216; France 2,546.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1985	1986[2]	Sources, 1986	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude thousand 42-gallon barrels	491,422	489,730	—	United Kingdom 135,033; Nigeria 71,982; Saudi Arabia 53,228.
Refinery products:				
Liquefied petroleum gas do	10,316	9,805	(3)	Netherlands 2,329; United Kingdom 1,880; Belgium-Luxembourg 1,544.
Gasoline do	96,025	97,436	207	Netherlands 35,643; U.S.S.R. 17,930; Belgium-Luxembourg 7,140.
Mineral jelly and wax do	1,594	1,717	265	France 242; Egypt 185; unspecified 621.
Kerosene and jet fuel do	16,754	18,003	63	Netherlands 13,740; Belgium-Luxembourg 2,182; France 945.
Distillate fuel oil do	158,783	183,106	318	Netherlands 91,922; U.S.S.R. 22,968; United Kingdom 12,794.
Lubricants do	2,516	3,415	121	France 1,054; United Kingdom 885; Italy 393.
Residual fuel oil do	59,763	52,251	—	Netherlands 15,239; U.S.S.R. 9,944 Belgium-Luxembourg 7,074.
Bitumen and other residues do	2,126	1,764	(3)	Netherlands 591; Hungary 250; France 236.
Bituminous mixtures do	118	119	2	Netherlands 58; France 22; Hungary 18.
Petroleum coke do	6,883	8,056	7,144	United Kingdom 276; Argentina 183.
Unspecified do	397	—	—	

r Revised. NA Not available.
[1] Table prepared by Josef Plachy.
[2] Excludes trade with East Germany.
[3] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Poor ore grades, the high cost of mine operations, stringent environmental controls, strong competition from abroad, and declining world demand for the basic metals led the FRG to close virtually all of its metal-producing mines. The last iron ore mine, Leonie, in Auerbach, east of Nürnberg in Bavaria, which had operated since the Middle Ages, closed in May. In February, MG closed two of its lead-and-zinc mines in the Harz Mountains. These mines employed about 825 workers and were the sole source of byproduct silver in the FRG. The only remaining lead-and-zinc mine, at Meggen, produced mostly zinc. The FRG thus had to rely mainly on imports not only for its iron, lead, silver, and zinc, but also for gold and most other metals. Domestic and imported secondary metals and scrap were refined, and attempts were made to reclaim metals from mine wastes. Preussag Metall AG, near Goslar, for example, was experimenting with reclaiming copper and zinc from waste piles by an in situ biological leaching process using microorganisms mainly *Thiobacillus ferro-oxidans*.[4]

Aluminum.—Vereinigte Aluminium Werke AG (VAW), the largest FRG producer, sold one of its works, Leichtmetall Castens und Krohn (LCK), to the international metal stockholder, Aalco Ltd. of the United Kingdom. LCK, in Hamburg, was a distributor of aluminum semimanufactures. Aalco had four other plants in the FRG—Düsseldorf, Nürnberg, Regensburg, and Stuttgart.

VAW, headquartered in Bonn, produced primary aluminum and aluminum products, coal, gallium, graphite, and materials for ceramics. The company employed about 10,215 workers at its 11 plants.

Alcan Aluminium Werke AG, owned by Canada's Alcan Aluminium Ltd., closed its smelter at Ludwigshafen in February. The plant was producing only at about one-half of its 44,000-ton-per-year capacity. Alcan sold 185,000 tons of aluminum products in the FRG in the first half of the year, down 9% compared with the same period in 1986. At yearend, Alcan's FRG operations were

merged into one company, renamed Alcan Deutschland GmbH, headquartered at Eschborn and Taunus. The merger was part of Alcan's restructuring of its finished and semifinished products lines. Rolled products were to be concentrated at Göttingen, foil at Lüdenscheid, foil finishing at Ohler, and pistons and castings at Nürnberg.[7]

Antimony.—Erdol und Chemie Div. of Preussag developed a method for producing antimony trichloride and antimony trioxide from impure sulfide ores that were previously unusable because of metallic impurities. In the new method, the finely ground ore reacts with gaseous hydrogen chloride in a molten salt. The sulfur is driven off as hydrogen sulfide, which is collected in an alkaline medium and processed into by-products.[8]

Copper.—Norddeutsche Affinerie AG at Hamburg produced about 62% of the FRG's copper and operated the largest primary copper smelter in Europe. However, the company sold 30% of its shares to MIM. MIM also owned about 5% of MG. By yearend, three companies held major stock in the smelter: MG and MIM, 35% each; and Degussa AG, 30%.

Germanium.—KHD Humbold Wedag AG of Köln tested a process for extracting germanium, lead, and zinc, from flue dust collected from lead processing. The CONTOP process consists of a reducing, cyclone-smelting phase, followed by the evaporation of the metals through top-blowing of coal. More than 90% of the germanium, lead, and zinc were precipitated as oxides. The residue also contained significant quantities of SiO_2, Fe_2O_3, chlorides, and fluorides from the coal.[9]

Iron and Steel.—Klöckner Werke AG, which owned 49% of the FRG's last iron ore mine, shut down the Leonie Mine in Sulzbach-Rosenberg near Auerbach in eastern Bavaria in May. Output at Leonie reached a peak in 1962 at almost 19 million tons of ore, or 4.2 million tons of metal content. In 1987, only 500,000 tons was produced; most of the ore was sedimentary and of Upper Cretaceous Age.[10] The mine had operated under the name of Eisenwerk-Gesellschaft Maximilianschutte mbH (Maxhutte). The closure was caused by competition from abroad, difficult underground working conditions due to water problems, and low ore grade. The mine had operated since the Middle Ages, and in 1986, it employed 292 workers, 214 of which were underground miners. In 1987, 263 workers remained. The Maxhutte shutdown cost Klöckner about $230 million in 1987; it had reported an operating profit of $27 million in 1986.

The mine closure turned Klöckner into a producer of flat steel products. Klöckner, the city of Düsseldorf, and the Bavarian State drafted plans to rescue Maxhutte by forming a new steel company. By yearend, a new steel company was formed, Neue Maxhutte Stahlwerke GmbH, integrating the activities of the bankrupt Maxhutte. Bavaria was given 39% ownership and the rest was divided evenly among the seven leading FRG steel companies. Neue Maxhutte was to operate a blast furnace, two oxygen converters, two continuous casters, a blooming mill, and a section mill at Sulzbach-Rosenberg. Also, by yearend, another new company was formed, ESW-Rohrenwerke GmbH, to manage Maxhutte's tube works at Eschweiler, formerly called Echweiler Bergwerks-Verein Huttenbetriebe. The plant produced tubes of 70- to 219-millimeter diameter, and it had an annual capacity of about 60,000 tons. Unemployment in the Sulzbach-Rosenberg area reached 40%, or four times the national average.[11] Since 1980, Maxhutte had received about $115 million in Bavarian State aid and reduced its work force by about 6,500.

In addition to Bavaria, other States were affected by the steel crisis, and the Government pledged $110 million in subsidies to the States of Lower Saxony, North Rhine-Westphalia, and Saarland. The steel companies and the union sought $365 million in Government aid. It was estimated that from 25,000 to 45,000 jobs would be lost in the next 2 years, owing to a weak steel market; The Ruhr Valley of North Rhine-Westphalia would suffer the greatest unemployment. Over 200,000 jobs had already been lost in the valley during the last decade.[12] Since 1980, Hoesch AG, Krupp Stahl AG, Mannesmann AG, and Thyssen AG had invested over $1.2 billion in the Ruhr Valley.

The FRG ranked fifth in the world in the production of raw steel, with 5% of the world's output, and the country's 8 major steel companies were among the top 47 world steelmakers.[13] Almost 85% of the country's total steel output was produced by continuous casting, compared with 77% in 1984. Only Denmark produced steel entirely by continuous casting. By contrast, continuous casting in the U.S.S.R. constituted only

14% of the total. Of the total output, 81.7% was produced by the oxygen process, the rest by the electric process.

Reportedly, FRG authorities had uncovered a steel-smuggling operation involving the sale by European traders of more than $120 million of steel from the German Democratic Republic (GDR) in Western Europe, the United States, and Turkey in 1985 and 1986.[14] The companies were accused of falsely labeling the steel as of EEC origin to evade the Community's quota on GDR steel. According to FRG customs in Düsseldorf, which led the investigation, the steel traders included well-known companies. A Government official confirmed that 160,000 to 200,000 tons of GDR steel worth up to $90 million had been "smuggled" into EEC countries, and that another 74,400 tons of GDR steel was sold in the United States, probably as steel from the EEC. In addition, 51,000 tons of the contraband steel was exported to Turkey with false papers. The department said that it was investigating the whereabouts of 900,000 tons of GDR steel shipped from the FRG free ports of Lübeck and Hamburg in 1985 and 1986.

The FRG's seven major steel companies had operated profitably since 1984 and Salzgitter AG since 1985.[15] By 1987, however, most FRG mills had become unprofitable. Thyssen Stahl AG, Europe's largest privately owned steel mill, announced plans to reduce the work force at its Niederrhein works at Oberhausen by a further 3,000 workers to only 1,000; the plant had employed more than 9,000 workers in 1978. The plate-rolling mill at Oberhausen was to remain closed until mid-1988. Also, there were plans to cut 2,900 jobs at Hattingen's Heinrichshutte plate mill, and to close it in 1988. Both of Hattingen's blast furnaces were in the process of being taken out of operation in 1987. Since December 1986, Thyssen closed two unprofitable section production plants, thus completely abandoning light sections. Only one 3.7-meter plate mill remained, at Duisburg. Thyssen cut its raw steel production 7% below 1986 levels, owing to a decline in steel prices and sales. Thyssen Edelstahlwerke AG, the company's stainless steel producer, was Thyssen's only profitable division. The company pledged to invest about $1.5 billion worldwide by 1988, mostly in the Rhine and Ruhr areas.

Hoesch Stahl AG, the second-largest steel producer, was one of the companies that was profitable. It concentrated on the production of high-value sheet products, while its other steel operations registered losses.

Krupp Stahl AG made a $3 million profit; that figure was, however, $40 million below the 1986 result. Most of the losses came from the declining sales of steel sections. Restructuring costs associated with a planned merger and strikes at its Rheinhausen steelworks in Duisburg cost the company about $18 million. The company announced in November plans to close Rheinhausen in the industrial Ruhr, causing the 5,300 workers to demonstrate for job security. In a compromise, the company was to proceed with the mill closure but would create substitute jobs or give early pensions to all but 1,300 of its workers.[16] The Iranian Government owned 25.1% of Krupp and had a representative on the supervisory board. Consistent with the trend in the FRG steel sector, Krupp was moving away from bulk steel and into special steels, capital goods manufacturing, and trading. Krupp's steel sales accounted for only about 20% of total group steel sales, compared with 27% in 1980.[17] Krupp began as a shipbuilding concern in 1896 and diversified into steel. In 1987, 30% of its research and development funds were spent on machinery, equipment, electronics, process engineering, metallurgy and materials, representing 6% to 8% of the group's turnover.[18]

Mannesmann AG, the country's fourth-largest steel producer, was also a leading manufacturer of steel pipes and tubes, machinery, and metallurgical plants. In 1987, the group's sales fell by 8%. Foreign sales, which accounted for 61% of the company's activities in 1986, fell 5% during the year. Also, Klöckner AG reported losses from its steel division, Klöckner Werke.

Lead and Zinc.—Preussag, the FRG's largest producer of base metals, made only a modest profit, although sales improved by about 10%. The company acquired the metal trading company, W & O Bergmann GmbH & Co., whose profit was $1.4 billion in 1986. The company announced plans to close its 75,000-ton-per-year secondary zinc smelter at Harlingerode in 1988. In 1987, it operated at only two-thirds capacity. The plant employed about 500 workers and was the last operating zinc smelter in Europe using the old New Jersey zinc process. The secondary lead unit at Harlingerode, which was to remain in production, produced more than 40% of its secondary lead—about 45 tons—from spent batteries. The company was to concentrate its zinc production at its second, 120,000-ton-per-year, electrolytic re-

finery at Nordenham. Preussag became the sole owner of the 120,000-ton-per-year-capacity Nordenham lead smelter by acquisition of the 50% owned by the Swedish firm, Boliden AB.[19] Production at the 55,000-ton-capacity Goslar zinc refinery was stopped for economic reasons.

The FRG Government announced in February plans for the indefinite closure of the Rammelsberg and Bad Grund lead-zinc-silver mines in the Harz Mountains because of falling prices and high operating costs. The mines had operated since the Middle Ages, and, in 1986, they employed 437 and 387 workers, respectively. In 1986, the Rammelsberg Mine produced 279,000 tons of ore, and the Bad Grund Mine produced 267,000 tons. The combined yield was about 113,000 tons of zinc in concentrate and 25,000 tons of lead in concentrate. The reserves at Rammelsberg were almost exhausted. The mines were the sole remaining source of byproduct silver in the FRG. The closure left one operating lead-and-zinc mine, the Meggen Mine east of Bonn, owned by MG. It has been in operation for more than 130 years and produced about 1 million tons of lead and zinc ore per year, mostly destined for zinc concentrate production.

Hamburger Metallkonter GmbH reportedly discovered a significant lead-zinc-silver prospect in Bavaria, close to the Czechoslovak border, using geochemical data. The anomaly is 3 kilometers long along the strike and up to 1 kilometer in width.[20]

Other Metals.—Degussa developed a powder-metallurgy injection-forming process, followed by binder elimination and sintering, for the production of highly complex hard metal parts, such as tungsten carbide with cobalt or nickel binders. With the Swiss company Vereinigte Drahtwerke Biel AG, Degussa built a pilot plant in the FRG for the production of up to 2 million parts per year, fabricated in two separate furnaces. The alloys, Bidurit FX-15, FX-30, and Ni-15 are composed of tungsten carbide and tantalum-niobium carbide and with cobalt binders at 7.5% and 15%, respectively, and tungsten carbide with 7% nickel binder. The two companies experimented with other alloys, such as ferrous metals, nickel superalloys, and others. The mechanical strength values obtained by this process were equivalent to those obtained by the conventional sintering methods.[21]

INDUSTRIAL MINERALS

Barite.—Only three operating barite mines remained in the FRG; the others had been shut down either because they became uneconomical or their reserves were depleted. Exploration, however, continued in the Harz Mountains near the Fulda River in the Dill area and at the Nohfelden-Eisen Mine in Saarland. Offshoots of the main ore body were discovered near St. Andreasberg in Harz, and Siegbach-Wallenfels and Oberscheld in Dill, with no plans to exploit them. The FRG met about 56% of its apparent consumption from domestic resources; 70% of this output was consumed in the production of chemicals and lithopone, 25% in fillers, and the rest in drilling.

Sachtleben Bergbau GmbH and Kali-Chemie AG were the two major domestic barium chemicals producers. The two companies jointly owned Duetsche Baryt-Industrie Dr. Rudolf Alberti & Co., which operated a mine at Wolkenhugel and a processing plant at Bad Lauterberg. Production capacity was 50,000 tons per year of filler-grade and 5,000 tons per year of chemical-grade barites. Sachtleben also operated mines at Dreislar and Wolfach, with plants in Hallenberg-Liesen and Wolfach, producing 50,000 tons per year of lumpy barite and 60,000 tons of filler as well as some barite for drilling. In 1986, the work force at the Dreislar Mine had been reduced by 50% to 22 workers, and production was cut from 65,000 to 40,000 tons because of high operating costs.[22] Kali-Chemie also operated subsidiaries in Italy and France, and its mining operations in Córdoba, Spain, were closed at midyear. The company was the sole supplier of barium and strontium carbonate to the Republic of Korea. The chemicals were manufactured by Kali-Chemie at Bad Honningen near the Rhine and at Massa in Italy. Other FRG processors of barites were Hansa-Metall Braun Mineral-und Metallhandels GmbH at Duisburg and Johannes Scheruhn GmbH & Co. Scheruhn did not operate its Talkum-Bergbau Mine in 1987 owing to a decline in profitability.[23]

Bromine.—Kali und Salz AG, headquartered at Kassel, was the only producer of bromine in the FRG. Of the three previously operating mines, only the 2,500-ton-per-year Salzdetfurth Mine, north of Kassel, remained open. Production from both the Friedrichsthal and the Berg

annssegen-Hugo Mines was discontinued.

Cement.—The FRG was the second-largest producer of cement in the EEC. About 36 cement companies operated 65 plants. The leading producers included, in descending order, Heidelberger Zement AG, Dyckerhoff AG, Anneliese Zementwerke AG, Alsen-Breitenburg Zement-und Kalkwerke GmbH, and Nordcement AG. Production had steadily declined from 35 million tons in 1979 because of falling consumption and low-cost imports from the centrally planned countries. The FRG exported about 5% of its production, mostly to the Netherlands, and largely in the form of special types of cement including oil well and various construction cements, some for FRG companies working in those countries.[24] Heidelberger Zement held a 65% ownership in Lehigh Portland Cement Co., a U.S. company.

Bonner Zementwerke GmbH, the country's oldest cement company, ceased production and sold its kilns to Turkey. Clinker production was stopped by Hannoverische Portland Zementfabrik AG, Heidelberger Zement in Neumarkt, Hellbach-Zement GmbH, Kalk-und Zementwerke Marienstein AG, and Zementwerk Saar GmbH. Other companies improved their operations by installing high-efficiency separators, filters, high-pressure grinding rolls, and conveying and dispatching systems.

Lime.—The FRG was the world's fourth-largest producer of lime. With some yearly fluctuations, production had remained quite stable for more than a decade. Two companies dominated the industry; Rheinisch-Westfalische Kalkwerke AG (RWK), the largest, headquartered in Wuppertal, and Rheinische Kalksteinwerke GmbH of Wulfrath (RKW); Thyssen AG owned 75.1% of the latter. Both produced only burnt lime. Several smaller companies also produced sintered dolomite, soft-burned dolomite, and hydrated lime. RWK quarried and burned Massenkalk Devonian limestone at three locations near the company's headquarters, about 12 miles northeast of Düsseldorf. RWK also quarried Devonian limestone at four sites: Darnap, near Wuppertal; Honnetal, near Dortmund; Stromberg, near Bingen on the Rhine; and Steeden, near Limburg. More than 72% of the burnt lime was exported to European countries for use by the iron and steel and construction industries.

Potash.—Kali und Salz ranked fourth in the world in the production of potash, and the FRG was also the second largest market in Western Europe. However, production had remained virtually unchanged for the past 2 years because of low demand. Of the eight operating mines, three in the Hannover area were directly affected by declining sales. The smallest mine at Siegried-Giesen was to close permanently while capacities were reduced at the Bergmannssegen-Hugo and Salzdetfurth Mines. Those actions also affected the jobs of 900 workers.

Kali Export Gesellschaft (KEG) handled all FRG's sales to non-EEC countries in Europe, which made up about 30% of its total exports. KEG's next largest market was Asia, where sales were based primarily on long-term contracts.[25] The 1986-87 12-month exports totaled about 1.29 million tons of K_2O. The FRG had no restrictions on imports, but they remained low and unchanged at about 110,000 tons per year of K_2O, originating mostly in France and the German Democratic Republic.

Synthetic Wollastonite, Diopside, and Mayenite.—FRG's Rheinische Kalksteinwerke GmbH in Wulfrath was a major European commercial producer of synthetic lime-containing minerals. Wollastonite and diopside were manufactured for use in ceramics and metallurgy. Mayenite, the most recent entry in the company's inventory, was used only in secondary metallurgy. The minerals were synthesized in a modified rotary kiln.[26]

MINERAL FUELS

Coal and nuclear energy remained the primary sources of electric power, which increased by 2.2% in 1987 compared with that of 1986. The share of nuclear power rose from 3% in 1970 to about 37% in 1987, while that of petroleum fuels fell from 15% to less than 2% in the same period. More than 50% of total electric production was generated from domestic coal. The share of oil in primary energy consumption including transportation, however, was the highest at 42%, followed by coal at 19%, natural gas at 17%, nuclear power at 11%, and lignite at 8%. About 64% of the primary energy fuel sources was imported. Nuclear power stations continued to operate at nearly 80% of capacity. The Government also continued to support new reactor technologies. It remained committed to the construction of a spent fuel reprocessing plant in Wackersdorf, Bavaria, despite some active opposition to nuclear power.

Coal.—There were 32 operating coal

mines in the FRG. Since 1981, the production of coal had continued to decline. About 2 million tons of coal was stockpiled during 1987, increasing the existing stock to 15 million tons. Production in the mines was more than 115% of normal output. According to some reports, three main coal producers were to reduce their capacities: Ruhrkohle AG by 10 million tons, Eschweiler Bergwerks-Verien AG by 3 million tons, and Saarbergwerke AG by 1 million ton.[27] The cost of domestic coal was more than three times the price of imported coal. Despite this, however, only about 9 million tons of coal was imported, and coal production subsidies continued, amounting to about $7 billion per year. Only about one-fifth of the coal mines were competitive, and for environmental reasons, coal mining was moving north into the rural Muensterland area. The industry employed about 164,000 people in 1986, compared with 204,000 in 1973.

Natural Gas.—Natural gas was the third-largest primary energy source in the FRG. Consumption of natural gas rose from a 1986 decline because of cold weather and higher sales to industry. About 27% to 30% of gas supply came from domestic sources. On May 31, 1986, a consortium of Western European companies, including the FRG importers (Ruhrgas, Thyssengas, and Brigitta und Elwerath Betriesbsfuhrungsgesellschaft) agreed to import gas from Norway's Troll and Sleipner North Sea fields. The agreement, approved by the Government in August, covered imports of about 282 billion cubic feet of gas per year during the years 2000 to 2020. The agreement was another step toward broadening the Western European sources for the FRG gas market, thus assuring a more stable supply.

Petroleum.—Production declined for the third year, and domestic output contributed only marginally to the FRG's energy balance. Because the FRG was the largest European market for petroleum and had adopted strict emission controls, the Government was concerned with diversification and security of supply. Dependence on oil from the Organization of Petroleum Exporting Countries had been cut by more than one-half during the last 15 years and the FRG paid less for its oil imports, $9.7 billion, than in the previous year. Because of international competition and overcapacity in the European refining industry, however, FRG oil companies continued to lose revenues. Refining capacity had been halved since 1978, to 612 million barrels per year in 1987. Ruhr Oil GmbH in Gelsenkirchen, the largest refinery, has a capacity of about 80 million barrels per year and was jointly and equally owned by Veba AG and Petroleos de Venezuela SA. Shell Oil Co. was the country's major refiner. FRG's refineries met about 70% of the country's petroleum product demands. To maintain capacity, Holborn Europa Reffinerie GmbH, a subsidiary of Coastal Corp. of the United States, took over the mothballed Esso Corp. refinery in Hamburg, which had a capacity of 34 million barrels per year. Opening of other closed plants was being considered.

Of the 50 to 60 independent oil trading companies in the FRG, most received their supplies from the Amsterdam-Rotterdam-Antwerp area, mainly by barge. In 1986, about 205 million barrels of oil entered the FRG at Emmerich on the Rhine River. The Rhine was the main transport route, usually in 1,200-ton barges. Some of the oil was transported through pipelines. The FRG had 1,065 miles of pipeline for crude and 315 miles for refinery products.[28]

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